Amendments to the Specification

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The bit-interleaved coded modulation (BICM) encoding method of the present invention uses a conventional convolution encoder **110**, a bit interleaving matrix **120** and a conventional QAM mapper **130** , as depicted in Figure 1. The BICM encoder **100** can also be concatenated with an outer Reed-Solomon encoder.

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In a presently preferred embodiment, the convolution encoder **610** is a preferably punctured rate ½ convolution encoder with k=7 constraint length and generating polynomial 171 octal and 133 octal, as depicted in Figure 6. The coded bits are used to fill the rows **710** of the interleaver matrix **700** and are read column wise **720**, as depicted in Figure 7. The preferred mapper uses Gray code mapping. Before the first data bit, the convolution encoder is initialized to a pre-determined state (e.g. all zeros). After the last data bit, the state of the encoder is brought to a pre-determined value by feeding dummy data bits into the encoder (e.g. feeding six zero bits).

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The method is very similar to the conventional Viterbi method for convolutionally encoded QPSK or BPSK signals. As depicted in Figure 2, ~~it~~BICM decoder **200** is implemented by three units[[:]] **210, 220, 230**.

A Score Calculation Unit **210** outputs the approximated scores of each channel bit.

Due to Gray code mapping, the real part and the imaginary part of the QAM symbols can be decoupled into two independent real valued PAM symbols, where each channel bit effects only one such PAM symbol. Thus, the approximated score of the channel bit *b* given “0” value, denoted by $L_0(b)$, is the square of the distance of the real or imaginary component of the decoder input to the nearest PAM symbol having a “0” value in the corresponding bit position. Similarly, $L_1(b)$ is the squared distance to the

nearest PAM symbol having a “1” value in the corresponding bit position. Figure 3 depicts a scoring example for a 16 QAM constellation map.

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As depicted in Figure 2, the scoring for each bit is deinterleaved using the Bit Deinterleaver Matrix **220**. The matrix is filled column-wise and read row-wise.

Next, convolution decoding (Viterbi Algorithm Unit) **230** is performed; the unit implements a method which is *exactly identical* to the well known 64 states Viterbi algorithm for soft decoding of convolutionally encoded BPSK (or QPSK) signal, except for a single difference: It uses the approximated scores calculated by the score calculation unit, rather than the conventional scores (which are the squared distances from the “0” and “1” levels of the binary signal). These methods implement 128 branches per bit for rate ½ code, and possibly less than that for punctured codes. There are several low cost IC’s that implement such methods for data rates of more than 30 million information bits per second (e.g. DBS receivers). The cost of these IC’s also includes A/D conversion, re-sampling, filtering, acquisition, de-interleaving, and Reed-Solomon decoding is below $10, and their power consumption is in the range of 1W or below. (See e.g., “*Digital Communications*", J.G. Proakis, 3rd Edition, McGraw Hill, 1995, pp. 483-486 for a description of the conventional algorithm).